

THE PELVIC SURVEY*

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From the standpoint of child-bearing, the interest of obstetricians in the female bony pelvis is not limited to pelvic dimension, for morphology of the pelvis is also of importance. Of interest too are those factors which may influence the development of the pelvis during childhood and the puberal period. When we consider methods which will show pelvic capacity and pelvic morphology in the living individual, we find that only roentgen technics are able to give us knowledge of the upper bony birth canal, and that the lower portal or outlet can be satisfactorily evaluated by palpatory methods. For clinical purposes a satisfactory survey, therefore, should combine both measures and it is the purpose of this communication to describe the technics now in use in this clinic. In considering the former, it is obvious, for the sake of practical application, that roentgen methods should aim at simplicity in interpretation and at a minimum of expense. Both of these objectives are obtained in the use of two roentgenograms, one obtained by projection from above downward with the target centered on a line at right angles to the plane of the pelvic inlet, and the other projected laterally.

In the inlet view the shape and dimensions of the pelvic inlet and the midplane can be measured, and certain outlet characteristics can be made apparent, while in the lateral view the lateral aspect of the pelvis may be studied and certain anteroposterior dimensions obtained. For the inlet view we are using a modification of the grid technic, which was originally devised in this clinic and later modified.⁸ In this maneuver a scale of "corrected" centimeters appears at the edge of the film, whereby correction of distortion due to the spread of the x-rays can be made for the pelvic inlet and other important levels.

The entire bony pelvic canal is obstetrically important. This is particularly true in those instances where the upper pelvis (inlet) may show adequate pelvic room and the lower pelvis (midplane) show a restricted capacity. When such midplane contraction occurs the fetal head usually shows good engagement but labor becomes

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increasingly difficult as the head attempts to pass the lower pelvis. In a study by Schumacher and the author⁷ of 153 individuals in which this type of pelvic contraction was present, the relation of such contraction to operative intervention may be seen from a concluding statement, "In summarizing this experience we wish to observe that midplane pelvic contraction, as indicated by shortening of the transverse diameter, combined or not with shortening of the midplane anteroposterior diameter, is definitely associated with increased operative intervention during labor. When the midplane is 9.5 cm. or less and other diameters remain in average limits, according to this study the incidence of intervention was 45.2 per cent. When midplane anteroposterior shortening was also present, operative incidence was 65.0 per cent."

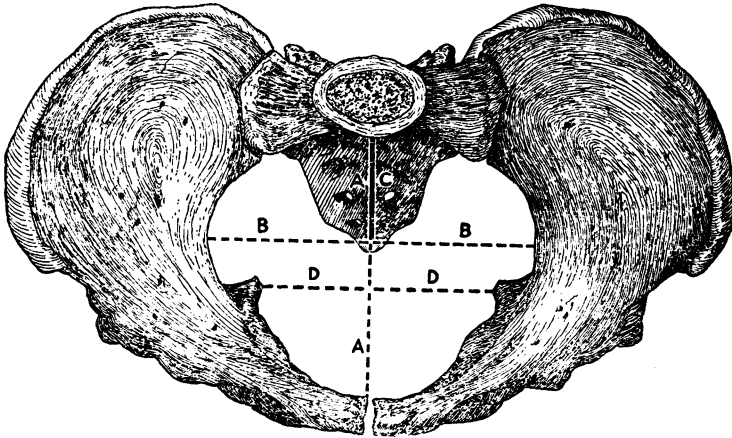


FIG. 1. A. Anteroposterior diameter; B. Transverse diameter; C. Posterior sagittal diameter; D. Transverse diameter of midplane.

In addition to the inlet and midplane dimensions, an examination of the pelvic outlet is important, particularly the interpuberal space or pubic arch. Here the estimation is best carried out by palpation and the use of the pelvimeter, recently described⁸ and here illustrated, with which the symphysis biparietal and sacro-biparietal distances can be measured.

For obstetrical purposes the upper pelvic planes may be described as follows: the plane of the inlet is bounded anteriorly by the upper posterior surface of the symphysis pubis and the forward portions of the iliopectineal lines, laterally by the iliopectineal lines, and posteriorly by the posterior portions of these lines and the anterior surface

of the sacrum at the point where the convergence of these lines takes place. (This point may or may not be located at the sacral promontory.)

The essential diameters of the pelvic inlet are: (Figure 1)

1. *The anteroposterior diameter*, extending from a point on the upper posterior surface of the symphysis pubis, 1 cm. from its superior border, posteriorly to the anterior surface of the sacrum to the point where the iliopectineal lines would meet were they extended.

2. *The transverse diameter*, being the widest distance separating the iliopectineal lines.

3. *The posterior sagittal diameter*, being that portion of the anteroposterior diameter which lies posterior to its intersection with the transverse diameter.

The essential diameters of the midplane are: (Figure 2)

1. *The anteroposterior diameter*, extending from the lower posterior border of the symphysis posteriorly at the level of the ischial spines to the lower third of the sacrum, usually falling at or near the junction of the fourth and fifth sacral segments.

2. *The transverse diameter*, being the narrowest distance separating the ischial spines.

3. *The posterior sagittal diameter*, that part of the anteroposterior diameter which lies posterior to its intersection with the transverse diameter.

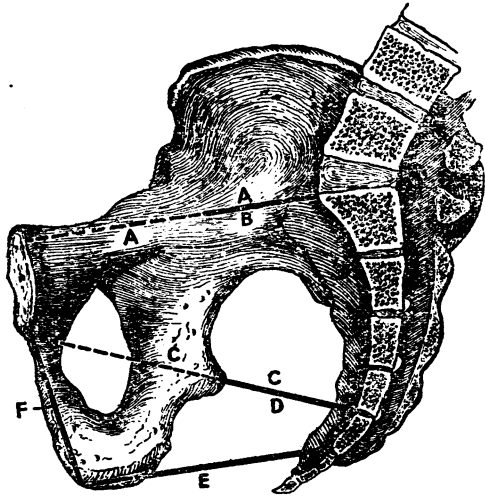


FIG. 2. Anteroposterior diameters seen in lateral aspect: A. Anteroposterior diameter of inlet; B. Posterior sagittal diameter of inlet; C. Anteroposterior diameter of midplane; D. Posterior sagittal diameter of midplane; E. Sacral-biparietal distance; F. Symphysis-biparietal distance.

These diameters are obtained roentgenologically using the technic described by Thoms and Wilson⁸ as follows:

For routine purposes we recommend the taking of two flat films, an inlet and a lateral view, as referred to above. In individual cases or for purposes of study during labor, other views may be useful and in this latter instance stereoscopic views may serve a very useful purpose. The inlet and lateral

views are both made at a target-film distance of 36 inches. When this distance is used, error due to spread is minimized and of equal importance the relative size values of the two images are helpful in studying the pelvis as a whole. It is obvious to us that an adequate survey of the pelvis is not possible without the employment of these two technics. Furthermore, inasmuch as the mensuration of the anteroposterior diameter of the pelvic inlet may be determined in both views, each procedure becomes an excellent check on the accuracy of the other. The technics that we are at present using are detailed below and represent a slight change in the lead grid from that which we have previously used. This has been made in order that in the inlet view the transverse diameters of levels other than that of the pelvic inlet might be measured.

The necessity of mensuration of these other levels has become apparent as the usefulness of knowledge so obtained has been applied to clinical obstetrics. In other words, not only a knowledge of the pelvic inlet but of the midplane and the pelvic outlet is essential for a proper obstetric survey of the pelvis.

Although changes in our technic have been described from time to time, an inevitable sequence in development in any field, it should be pointed out that in both the grid and the lateral technics the fundamental principle has remained the same. The present method of using the lead grid is identical with that described³ in 1927, the change being in the grid itself, which has additional calibrations. The lateral technic also is essentially identical with the original technic,⁴ the only change being the use of the upright posture and the upright centimeter rod. Our routine is to take the lateral projection first, and this technic may be described as follows:

1. The patient removes her clothing, putting on heelless slippers and the usual hospital bed gown open at the back.

2. She is placed standing in front of an erect Bucky diaphragm (see Fig. 3) or an adjustable cassette changer, such as is used for chest work, with either the right or left lateral aspect of the body toward the target. The arms are folded across the chest.

3. The target-film distance is 36 inches and the target is centered just below a point on the external conjugate diameter one-third the distance from the symphysis pubis to the depression under the fifth lumbar vertebra.

4. A binder is placed around the patient and attached to the cassette changer to insure further steadiness during the exposure.

5. Before the exposure is made, an upright metal rod (lead and iron) with a centimeter scale perforated in a lead strip is placed posterior to the patient close to the fold of the nates.

6. The time of exposure varies with the thickness of the patient, all other factors being constant; in general, the time is from seven to twelve seconds.

Comment on lateral technic. When the film is developed and viewed (see Fig. 4) the following landmarks should be readily identified: anterior and

posterior borders of the symphysis pubis, acetabula, ischial spines, ischial tuberosities, the lower lumbar vertebrae, the promontory and anterior surface of the sacrum, and the sacrosciatic notch. On one edge of the film may be seen the shadows cast by the perforations giving corrected centimeters in the sagittal plane of the patient. By means of calipers, using this scale, any diameters in this plane may be measured.

The advantages of this lateral technic may be summarized as follows:

1. All the anteroposterior diameters of the bony pelvis may be measured, including those of the pelvic inlet and midpelvis.
2. The levels of the ischial spines and of the lower inner surface of the ischial tuberosities may be determined in this view.
3. The contours of the anterior surface of the sacrum may be studied, a matter of importance in the recognition of sacral abnormalities, especially those due to the influence of rickets.
4. When lateral roentgenograms are made at term or in labor, the relation of the presenting part to the pelvic inlet may be studied with advantage.

The centimeter grid method for pelvic inlet pelvimetry may be described in its essentials as follows:

1. The patient is placed on the roentgenographic table in a semirecumbent position which is maintained by a backrest. In placing the patient in position we endeavor to make the pelvic inlet of the pelvis horizontal.

2. The level of the pelvic inlet above the sensitive film is established as follows: (a) By means of calipers the vertical distance is measured from some point on the table top to a point on the anterior surface of the symphysis pubis, 1 cm. below its superior border. (b) By means of calipers the distance is determined from the interspinous space between the fourth and fifth lumbar vertebrae, as determined by palpation, to the table top (see Fig. 5). For practical

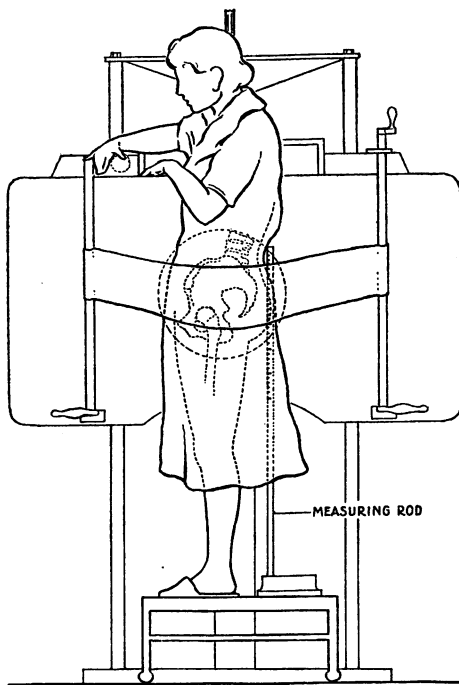


FIG. 3. The position of the patient for lateral pelvimetry. (In patients who may be in labor or who for other reasons cannot maintain the upright posture, the same technic may be carried out with the patient in the lateral lying position.)

purposes, an imaginary line drawn between the posterior point on the body and the point on the upper and anterior surface of the symphysis will bisect the plane of the pelvic inlet. This imaginary line should be parallel to the film and this is brought about by adjusting the position of the patient.

3. The tube is centered in the midline about 6 cm. posterior to the upper border of the symphysis and the exposure is made.

4. The patient is removed from the table, the tube and exposed film remaining in situ.

5. The centimeter grid, a lead plate with perforations along one edge, is introduced into the same plane as that previously occupied by the pelvic inlet (see Fig. 6), as determined by the caliper readings, and a second (flash) exposure made on the edge of the previously exposed film. This is done after moving the target so that it rests directly over the perforations in the grid, still maintaining the 36-inch distance.

In viewing the inlet film (see Fig. 7), the pelvic inlet, ischial spines, and pelvic sidewalls of the outlet are readily seen. At the top edge of the film are the projected perforations of the grid representing corrected centimeters for the various levels in the pelvis. The line of corrected centimeters at the top represents the level of the pelvic inlet and this scale is used in measuring the anteroposterior, transverse, and posterior sagittal diameters of the inlet. The five rows of perforations which are seen below this level are those to be used respectively for the 5, 6, 7, 8, and 9-cm. levels below the pelvic inlet. Thus, if we wish to measure the interspinous diameter on this film, we find the level at which they rest in the lateral film by measuring downward from the level of the pelvic inlet; if, for instance, this is 6 cm., then on the anteroposterior film we use the third or 6-cm. calibration for the determination.

When we seek for information concerning the adequacy of the pelvic outlet, it becomes obvious that the width of the subpubic angle and the shape of the pubic arch are of considerable importance. From a practical point of view, however, the important point is how close the occiput is allowed to approach the lower edge of the symphysis.

If we consider variations in the downward course of the pubic rami, it becomes evident that the degree of the pubic angle in itself may not give a good index to outlet capacity and may even be misleading. Figures 8 and 9 illustrate this point. In both instances identical pubic angles are shown with the same intertuberal diameters, yet the available space in the upper part of the two arches is quite different.

As an alternative to determining the subpubic angle and attempting to determine a transverse outlet diameter, the measurements of

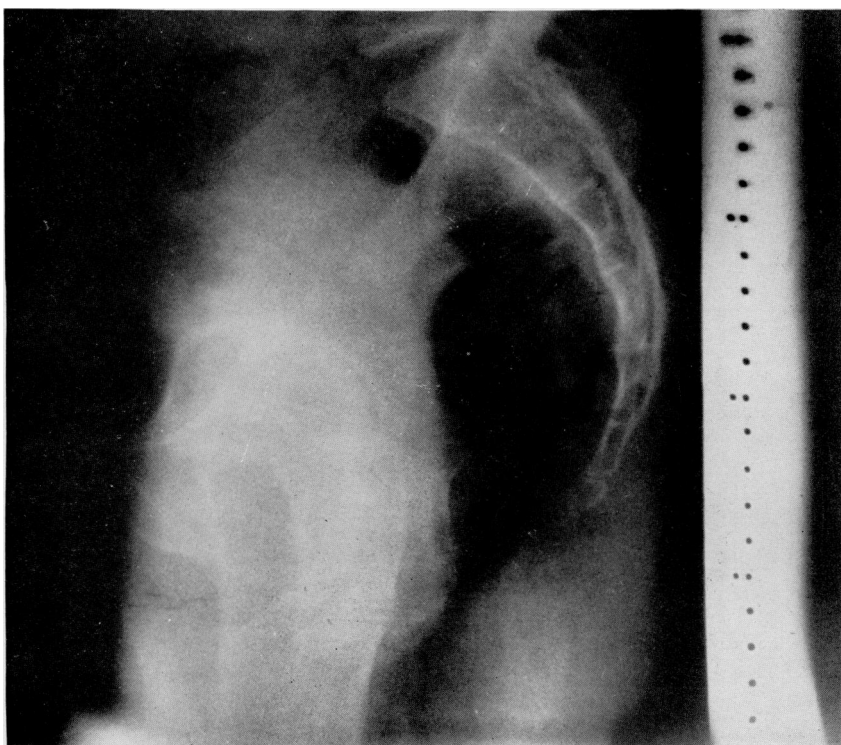


FIG. 4. Lateral roentgenogram of pelvis. The scale shows corrected centimeters in the sagittal plane. All measurements shown in Fig. 2 may be measured in this view.

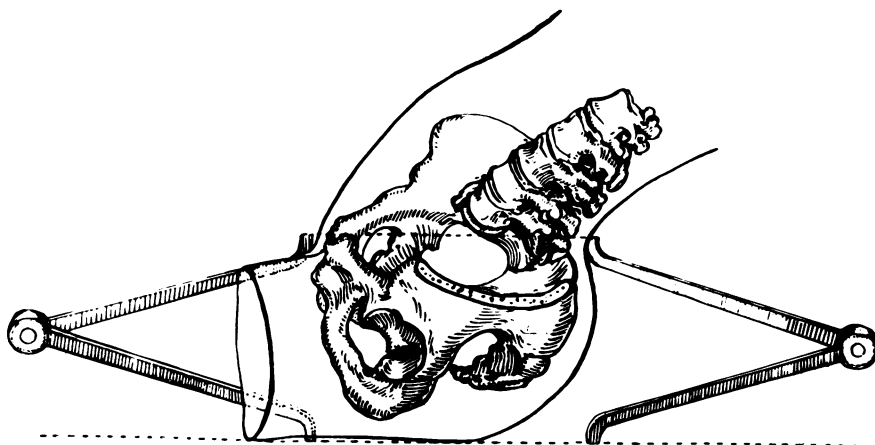


FIG. 5. The interspace between the fourth and fifth lumbar vertebrae is located and its height above the table may be made to correspond with the symphysis height as described. In order to do this the patient is shifted to the proper position, the distances being measured by the calipers as shown.

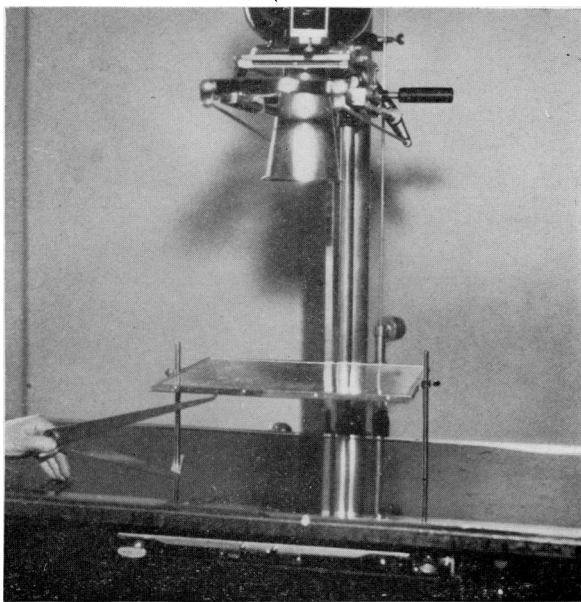


FIG. 6. The patient has been removed from the table, the exposed film and target remaining in situ. The lead grid is introduced in the plane previously occupied by the pelvic inlet as determined by the calipers. The target is then shifted to one side so as to be directly in line with the calibrations at one end of the lead grid, still maintaining a 36-inch target-film distance. A flash exposure imprints the "corrected centimeters" at the edge of the previously exposed film. (See Fig. 7.)

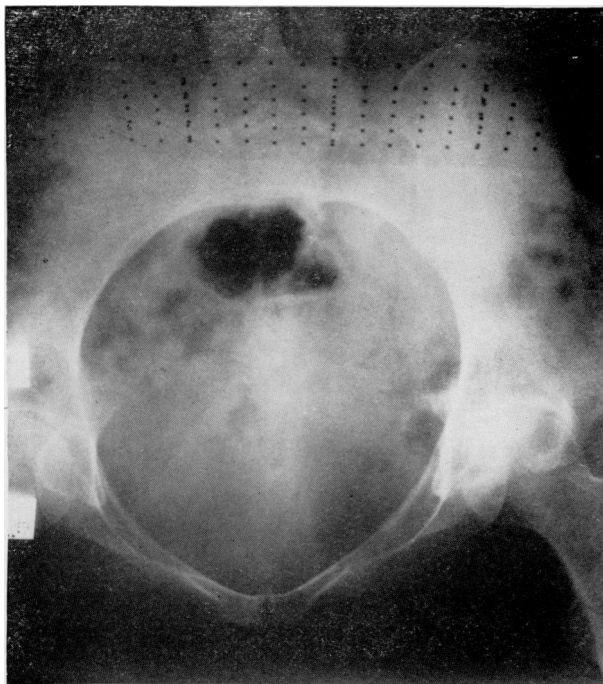
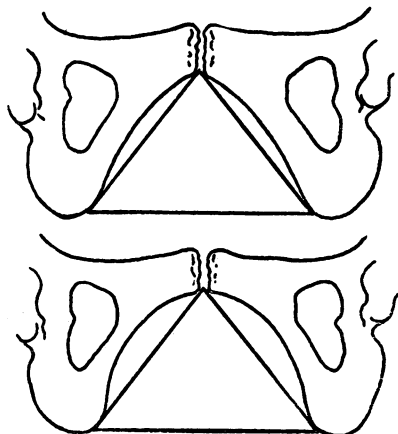


FIG. 7. Inlet roentgenogram of pelvis. The scale at the top represents corrected centimeters for the pelvic inlet and other levels of the pelvis.

the symphysis-biparietal distance has been recommended. This is the distance within which a normal biparietal diameter cannot approach the lower edge of the symphysis. This can be determined adequately by the palpatory method here described. Because of the difficulties, previously commented upon, of measuring the bituberous diameter, I find myself quite in agreement with Allen,¹ who says, "The bituberous diameter between the inner surfaces of the ischial tuberosities has also been discussed previously and the conclusion was then reached that this diameter could not be measured satisfactorily by any method so far described. The diameter, furthermore, is not of great importance *per se*, except in so far as it represents the free posterior end of the pubic arch: contraction of the arch always means a reduction in the intertuberous diameter, and since the arch can be more accurately measured, there seems to be little point in measuring the bituberous." In the pelvimeter here presented a cross-bar of 9 centimeters is used, allowing thereby about 0.5 centimeter for the thickness of the soft parts covering the pubic rami in their medial aspect, which represents an average of 93 millimeters, given by Scammon and Calkins.²



FIGS. 8 and 9. The pubic angles and bituberal distances are identical. The pubic arches, however, have important differences from the obstetrical viewpoint.

Method

The patient is brought well down over the edge of the examining table in the lithotomy position; the arch is thoroughly palpated by using both hands simultaneously as in the manner well described in text-books. The course of the rami downward is noted, whether straight, moderate, or widely arcuate. The cross-bar of the pelvimeter is then passed between the rami, and by upward pressure it is brought as near the symphysis as possible. As the cross-bar is held in this position, the end of the arm of the pelvimeter is brought to the lower edge of the symphysis and the symphysis-biparietal distance is read on the scale as shown (Fig. 10).

Another outlet dimension which should prove useful is the sacral-biparietal distance, as described, to the tip of the sacrum. This can be measured externally with the pelvimeter or it can be determined satisfactorily on the lateral film used in the general pelvic survey. This is accomplished by measuring downward between the shadows of the descending pubic rami the symphysis-biparietal distance previously determined. From the lower terminus of this distance to the tip of the sacrum represents the sacral-biparietal distance. The author is aware that the shadows of the pubic rami do not lie in the same plane and that the mean distance between them probably does not exactly represent the sagittal plane of the body. However, if films are taken at a target-film distance of 36 inches as recommended, the error encountered would not be obstetrically significant. For a further discussion of this aspect of roentgen pelvimetry the reader is referred to the author's views published elsewhere.⁵

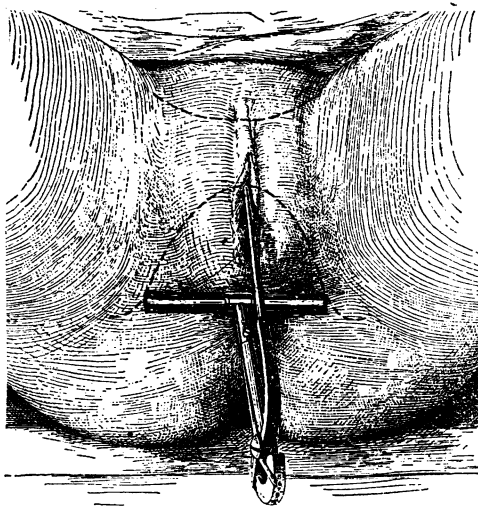


FIG. 10. The sliding cross-bar of a Thoms outlet pelvimeter has been replaced by a solid bar 9 cm. in length. After palpation of the arch this bar is brought to fit snugly between the rami. It is held in this position while the arm of the pelvimeter is placed at the lower edge of the symphysis. The symphysis biparietal distance is read from the scale. Modified from Williams.

In using the methods here described for surveying the bony pelvis it must be emphasized that morphological as well as dimensional information is important.

For this reason the observer should be familiar with the so-called normal variations of the pelvis, the changes which resemble characters found in male pelvises, the changes which are characteristic of the effect of rickets, and the various asymmetries and defects in development which may occur. Since the advent of the application of roentgenology, there has evolved greatly increased knowledge of this aspect of the subject, and the time has come to apply it more widely to clinical obstetrics. For this to be of greatest efficiency the obstetrician as well as the roentgenologist must be able to interpret roentgenological findings, and most certainly he should

make final clinical judgments. It is obviously unsound for the obstetrician to look to the roentgenologist to solve his clinical problems, for the obstetrical experience of the latter in most cases is bound to be limited. In conclusion, it must be re-emphasized that, even with the availability of this increased knowledge of pelvic morphology and dimension, the problems of childbirth still remain manifold and complex and must be viewed in their entirety in the scientific conduct of labor.

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